

Spread of the introduced yabby, *Cherax* sp (Crustacea: Decapoda: Parastacidae), beyond the natural range of freshwater crayfishes in Western Australia.

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Abstract

We report here on the presence of yabbies (*Cherax* sp, an exotic to Western Australia), in cave waters of an A Class Nature Reserve, near Eneabba, Western Australia. The geographic range of yabbies in Western Australia far exceeds that of freshwater crayfishes native to this State. It is argued that the spread of yabbies into natural waters beyond the distribution of native crayfishes is ecologically undesirable. However, the question of whether the spread of yabbies should be controlled has been applied only to their dispersion into waters containing native crayfishes.

Introduction

The natural distribution of freshwater crayfishes in Western Australia extends from the Hill River to the Kalgan River (Fig 1). This crayfish fauna comprises eight species in the genus *Cherax* [known in the vernacular as marron (*C. tenuimanus*), gilgies (*C. quinquecarinatus*, *C. crassimanus*, *C. glabrimanus*, and *C. neocarinatus*) and koonacs (*C. plebejus*, *C. preissii* and *C. glaber*)] and three species of *Engaewa* - strongly

burrowing crayfishes of very restricted distribution (*E. reducta*, *E. similis* and *E. subcoerulea*) from swamps near the coast between Dunsborough and Walpole (Riek 1967, 1969).

Yabbies (*Cherax destructor* and/or *C. albidus*) were introduced into Western Australia from Victoria in 1932, and spread by man throughout the southwest of the State (Morrissy & Cassells 1992). Austin (1985) first drew attention to the widespread occurrence of yabbies in this area, particularly in farm dams throughout the sheep and wheat farming districts. He classified yabbies as exotic to Western Australia, and raised the possibility that, should they spread from farm dams into natural habitats, they could displace marron (Austin 1985). Crayfish introductions to natural ecosystems can have many undesirable effects such as competition with native crayfishes, spread of disease, alteration of habitat through burrowing (Austin 1985) and co-introduction of symbionts, commensals, and parasites (Horwitz 1990).

Previous attention has focussed on the spread of yabbies into the southwest where their presence could be detrimental to the native crayfishes, especially marron (Morrissy & Cassells 1992). However, yabbies occur north of Perth, beyond the natural distribution of Western Australian endemic crayfishes, in natural waters including the Bowes and Hutt rivers, the Pilbara and hinterland of Carnarvon (Morrissy & Cassells 1992), and the Irwin and Chapman rivers (A Savage, pers comm). Despite this, no specific concerns have been expressed about the spread of yabbies in these northern areas.

We unexpectedly discovered yabbies (*Cherax destructor*) while sampling the streams of Aiyennu and Beekeepers caves near Eneabba (Fig 1) in June 1991. Both caves lie in Stockyard Gully Nature Reserve, an A Class Nature Reserve vested with the National Parks and Nature Conservation Authority for the conservation of flora and water, and pro-

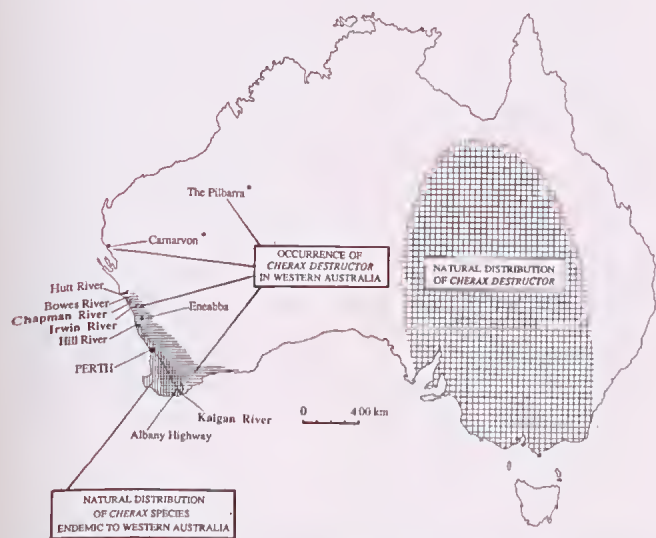


Figure 1. The natural distribution of freshwater crayfishes native to Western Australia, the known occurrence of the yabby (*Cherax destructor* and/or *C. albidus*) in Western Australia (a species exotic this State) and the natural distribution of the yabby in Australia. After: Austin (1986); Morrissy & Cassells (1992) and Riek (1969).

* mentioned in Morrissy & Cassells (1992) but the specific locations and range were not given.

tection of caves. We regard the spread of yabbies into a Nature Reserve as undesirable and raise here concerns over the spread of crayfish, and yabbies in particular, outside the natural distribution of crayfish in Western Australia.

Observations

Aiyennu (29°56'S 115°06'E) and Beekeepers caves (29°55'S 115°06'E), or E9 and E10 respectively after karst nomenclature (Matthews 1985), lie 21 km southwest of Eneabba within the Stockyard Gully Nature Reserve (# 36419 of 1406 ha). It is likely that the caves lie on the same stream in view of their similar physicochemistry (unpubl. obs.). Water depths varied between 0.5 m (Aiyennu) and 1.0 m (Beekeepers), but higher levels were clearly indicated by sediment horizons and chironomid larvae stranded on the banks of streams in both caves. No plant debris was observed within or about the water in either cave.

Invertebrates were abundant throughout the water column, with yabbies being the largest forms present. Composition of the aquatic fauna was similar in both caves and included oligochaetes, amphipods (*Austrochiltonia subtenuis*), copepods, dytiscid beetles, notonectid hemipterans, larvae of ceratopogonid, chironomid and stratiomyid dipterans. These invertebrates were the only obvious potential food source for the crayfish. In the accessible sections in each of Aiyennu and Beekeepers streams we observed about seven yabbies (ranging in size from about 5 cm to 15 cm total body length). These Eneabba specimens matched more closely the description of *Cherax destructor* than *albidus* (see Clark 1936).

Two yabbies from Aiyennu and four from Beekeepers cave were collected. These differed from surface crayfish in the lack of movement of eye pigments which remained constricted to the bases of ommatidia when tested with a range in intensity of illuminations using a halogen light source, and were slower in their normal locomotory movements and escape responses.

Speleological records

The trip reports of the two caving groups based in Perth typically record observations of cavernicoles. Hamilton-Smith (1965) noted the presence of a small aquatic snail in Aiyennu cave but made no mention of crayfish in any of the Eneabba caves. No yabbies were observed in the streams of either Aiyennu or Beekeepers caves during eleven trips reported between 1966 - 1984. There were no records of caving in either Aiyennu or Beekeepers from 1985 to 1988. Crayfish were first observed in Aiyennu in March 1989. These specimens were referred to as marron (Markey 1990) but since their identity was not confirmed (Markey, pers comm) we believe this name to be erroneous and instead presume the crayfish were yabbies.

Discussion

On the basis of the distributional data presented by Riek (1967, 1969) and the later report of Morrissy & Cassells (1992), it is reasonable to suggest that the freshwater faunas north of Hill River lacked crayfish before the recent introduction of yabbies. The effect of an exotic species of crayfish on the structure and composition of the fauna of local aquatic

ecosystems is an important issue which has been recognized elsewhere but not yet investigated here: "... once an 'exotic' crayfish is introduced into a lake or stream, it may impose considerable environmental stress on that system and, in all too many instances, irreparable shifts in species diversity occur" (Hobbs *et al.* 1989 p309). Spread of disease and displacement of native species through competition are discussed by Austin (1985) and Horwitz (1990). Yabbies are polytrophic, feeding on detritus, algae, live benthic and swimming invertebrates (Lake & Sokol 1986) and therefore have the potential to affect animals at various trophic levels. Their burrowing habits are likely to affect both the ecology of the benthos and water quality (Aller 1982). Therefore, it is important to assess urgently the impact of the introduction of yabbies into these northern river systems.

The recent presence of *C. destructor* in cave waters, about 40 km north of Hill River, highlights the spread of yabbies in Western Australia into areas beyond the natural range of crayfish. The presence of adult and juvenile crayfish in the two Stockyard Gully caves, together with their unusual eye and locomotory responses, suggest that the yabbies may now be established in the cave streams. We are unaware of the past or present distribution of yabbies in the wider Eneabba area, but Morrissy & Cassells (1992) report that yabbies were in Lake Logue before it dried up in 1986/1987. The Stockyard Gully karst does not support any surface waters but to the east, rivers and creeks flowing through private properties drain into the subterranean conduits of the Nature Reserve. In 1984, drainage from a neighbouring property into Stockyard Gully Cave was increased following excavation of the cave entrance (Jasinska *et al.* 1993). Hence, it is possible that yabbies entered the caves in waters draining the private properties east of Stockyard Gully Nature Reserve.

In a recent report on the spread of yabbies in Western Australia, Morrissy & Cassells (1992 p1) stated "In terms of both conservation issues and worthwhile additional production, any areal expansion of the present extensive harvesting of yabbies and, more especially, development of semi-intensive farming are best located in the warmer, near coastal, region north of Perth". Crayfish enter natural habitats either by escaping from dams and ponds (walking upstream or overland) or by human agencies. Therefore, until the impact of yabbies on ecosystems which do not contain an endemic crayfish fauna is ascertained, it would seem prudent to restrict crayfish farming to artificial ponds or tanks fitted with appropriate barriers to keep the crayfish from escaping, and to investigate ways in which dispersion of yabbies by humans into natural waters could be prevented.

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References

- Aller R C 1982 The effects of macrobenthos on chemical properties of marine sediment and overlying water. In: *Animal-Sediment Relations* (eds P L McCall & M J S Tevesz) Plenum Press, New York and London, 53-96.
Austin C M 1985 Introduction of the yabbie, *Cherax destructor* (Decapoda: Parastacidae) into southwestern Australia. *Western Australian Naturalist* 16:78-82.

- Austin C M 1986 Electrophoretic and morphological systematic studies of the genus *Cherax* (Decapoda: Parastacidae) in Australia. PhD Thesis, University of Western Australia. 376pp.
- Clark E 1936 The freshwater and local crayfishes of Australia. Memoirs of the National Museum of Victoria 10:5-58.
- Hamilton-Smith E 1965 Some preliminary notes on Western Australian cave fauna. The Western Caver 5:1-5.
- Hobbs H H III, Jass J P and Hunter J V 1989 A review of global crayfish introductions with particular emphasis on two North American species (Decapoda, Cambaridae). Crustaceana 56:299-316.
- Horwitz P 1990 The translocation of freshwater crayfish in Australia: potential impact, the need for control and global relevance. Biological Conservation 54:291-305.
- Jasinska E J, Knott B & Poulter N 1993 The sanctity of caves in Stockyard Gully Nature Reserve, with comments on definitions of National Parks and Nature Reserves. In: Conference papers of Tastrog, 19th Biennial Conference. Australian Speleological Federation, Hobart, 25-31.
- Lake P S & Sokol A 1986 Ecology of the yabby *Cherax destructor* Clark (Crustacea: Decapoda: Parastacidae) and its potential as a sentinel animal for mercury and lead pollution. Australian Water Resources Council. Technical paper No. 87.
- Markey A 1990 Caving up north - Encabba (somewhere near Dongara). March 27-29th Easter Trip Report. The Western Caver 39:20-24.
- Matthews P G 1985 Australian Karst Index. Australian Speleological Federation Inc. Melbourne.
- Morrissy N M & Cassells G 1992 Spread of the introduced yabbie *Cherax albidus* Clark, 1936 in Western Australia. Fisheries Research Report, Fisheries Department of Western Australia 92:1-27.
- Riek E F 1967. The freshwater crayfish of Western Australia (Decapoda : Parastacidae) Australian Journal of Zoology 15:103-121.
- Riek E F 1969 The Australian freshwater crayfish (Crustacea : Decapoda : Parastacidae), with descriptions of new species. Australian Journal of Zoology 17:855-918.